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Designing for the Light Metal Trades

The policy of the Council of the British Cast Iron Research Association, in so far as it seeks to establish good relationship with the architectural profession, is abundantly indicated in a Report* just published by the Board of Trade. This Report, "Design and the Designer in the Light Metal Trades," brings the influence of the architect on industrial activity into full relief. Sometimes his rôle is the hero and on other occasions the villain of the piece. The Report shows, through a careful analysis of a number of sections of this rather nebulous trade, that where the impact of the architect has been most marked—in electric light fittings, for example—there the most progress has been made. There are many types of architects, and amongst them there is the lazy type of individual, whose half-finished sketches are labelled "Details to be left to the builder." This same type causes endless trouble in the light metal trades by "lifting" a design from some manufacturer's catalogue and asking for quotations from all and sundry to be based upon it, details once more to be filled in by the contractor. The result is that one firm's original design is unwittingly filched by his competitors. The Report makes numerous references to "Parish Goods," that is a line of manufacture which has been standardised by tradition, much as was the bulk of the rainwater goods made before the days of rationalisation by the British Standards Institution.

This Report, which is quite long—too long, in fact—is patchily interesting. It consists of two parts, the first of which has been prepared by Mr. Richard Padley, an industrial investigator. The investigation was made in the immediate pre-war days, and its findings are none the worse for having been made at a time when business was the paramount factor. The second is the findings of committee, whose terms of reference were to give practical effect in the light metal and allied trades to the recommendations made in an earlier Report, "Design and the Designer in Industry." Mr. Padley has kept well in mind the importance of correct costing, and when dealing with hearth furniture recounts the following:—"One manufacturer told a story typical of this cycle of copying and price cutting. Among his products was a curb, customarily sold for 11s. One day a buyer offered him an order for 10,000 of these at the price of 5s. 3d. (this representing the price at which he had already bought quantities of that product). The manufacturer enquired why he wished to change his source of supply, and was naïvely informed that the previous supplier had gone 'bankrupt.'" The Report stresses that the copying of designs is not general, and is looked upon as being unsportsmanlike by the trade; when it does happen the lazy architect is usually to blame.

The Report, strangely enough, contains a most distorted picture of the enamelled sign trade; it is labelled "an offshoot of architectural metalwork." This is a pity, because quite good descriptions are given of several other trades. The "builders' brass foundry" trade, which embraces goods other than castings, suffers from an oversimplified description. A designer unfamiliar with foundry practice could not be blamed if he got the idea that here at last was a manufacturing process which would reproduce any complexity of shape his mind could evolve. In America, we are told, mass production of builders' brass castings is practised, as the designers of buildings are content to choose from a very small number of standardised patterns.

(*Continued overleaf, column* 2.)

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FORTHCOMING EVENTS

Institute of British Foundrymen

JANUARY 27.

East Midlands Branch :—"Moulding Sands and Gases in Relation to Casting Defects," by G. W. Nicholls. At the Technical College, Derby, at 6 p.m.

FEBRUARY 3.

Lancashire Branch :—"The Immersion Pyrometer in the Cast-iron Foundry," by R. C. Tucker, M.A. At the Engineers' Club, Albert Square, Manchester, at 3 p.m.

FEBRUARY 6.

Burnley Section :—"Gravity Die-Casting," by A. R. Palmer. At the Municipal College, Ormerod Road, Burnley, at 7.30 p.m.

FEBRUARY 9.

Middlesbrough Branch :—"Moulding Sands and Gases in Relation to Casting Defects," by G. W. Nicholls. At the Cleveland Technical Institute, Middlesbrough, at 7.30 p.m.

FEBRUARY 10.

Scottish Branch :—"Some Aspects of Light Alloy Foundry Practice," by M. R. Hinchcliffe. At the Royal Technical College, George Street, Glasgow, at 3 p.m.

West Riding of Yorkshire Branch :—"Aluminium Bronze Alloys: Their Foundry Use and Characteristics," by 6.30 p.m.

FEBRUARY 17.

Bristol Branch :—"A Study in Moulding and Casting Technique for Small Steel Castings," by E. G. Kelly, O.B.E. At the Grand Hotel, Broad Street, Bristol, at 3 p.m.

Lincoln Section :—"Moulding Sands and Gases in Relation to Casting Defects," by G. W. Nicholls. At the Technical College, Lincoln, at 3 p.m.

FEBRUARY 24.

Birmingham Branch :—"Costs in a Jobbing Foundry," by H. E. E. Holladay, B.Sc. At the James Watt Institute, Great Charles Street, Birmingham, at 2.30 p.m.

East Midlands Branch :—"Some Thoughts on Foundry Management," by J. Roxburgh. At Loughborough College, at 6 p.m.

FEBRUARY 26.

Sheffield Branch :—"The Study of Liquid Metal Temperature and Solidification Range as a Foundry Control by Means of a Thermocouple," by R. C. Tucker, M.A. At the Royal Victoria Hotel, Sheffield, at 7 p.m.

FEBRUARY 28.

London Branch :—"Inoculated Irons," by A. E. McRae Smith, M.A. At the Charing Cross Hotel, London, W.C.2, at 7.30 p.m.

(*Continued from next column.*)

final words of the Report are worth quoting: "It is as impossible to foster 'appreciation' of design by abstract and theoretical instructions as it is to design for the light metal trades without workshop experience or to acquire a fine palate for wines by book-keeping." It is highly probable that in the case of many returning soldiers, the pin-up girl will be replaced by "Kittens at Play" or "Lovers' Quarrels."

CORRESPONDENCE

(We accept no responsibility for the statements made or the opinions expressed by our correspondents.)

METHODS AND PROBLEMS INDIGENOUS TO A GENERAL IRONFOUNDRY

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—With reference to the above article, which appeared in your issue of January 11, may I point out to the authors that for the sweeping of the spurwheel (Figs. 8 and 9) I consider that it would be much better to have the sweeping board of the depth of the casting to be made, but extended so as to sweep the joint. By working off the joint, any additional setting and risk of variance of depth would be eliminated. Of course, there would be coreprints for the centre cores to slip over the pin—otherwise the general procedure would be the same as the authors describe.

Instead of the "atmospheric" blind risers, I would prefer to chill the spur face so as to inhibit any graphitic growth around the base of the teeth.—Yours, etc.,

G. W. DOUGLASS.

39, South Avenue, Washington,
Co. Durham.
January 15, 1945.

DESIGNING FOR THE LIGHT METAL TRADES

(*Continued from previous page.*)

The findings of the Committee as set out in Part II are not too clear cut, and he would be a brave man who dared to state that the problem of improved industrial designs in the light metal trades was even well on the way to solution. As would be expected, much attention is given to training industrial designers, with special reference to the Birmingham area. Then there are sections dealing with foreign competition and present standards, and in this second section the Committee has given a well-reasoned statement, but it contains no recommendation. The Committee's views on copying are greatly influenced by the acceptance of the notion that the copy is as usual inferior to the original, and with each extra copy further degradation is noticed. As to exhibitions, the Committee rightly point out that any new designs shown cannot be used in the right way. It does, however, favour the holding of exhibitions in the large departmental stores. Perhaps the most important recommendation made is in connection with design registration, where a suggestion is made that a panel should be established which would give a provisional ruling as to whether a design is (*a*) fit for registration, or (*b*) already an infringement. This ruling, it is suggested, should not be legally binding, but in practice it would carry weight in the courts. The

(*Continued at foot of previous column.*)

THE PRODUCTION OF BUILDERS' CASTINGS*

The repetition foundry and post-war demands

By CHARLES GILLESPIE

Since the outbreak of war the building of dwelling houses has been greatly restricted. In consequence, manufacturers of builders' castings have been obliged to turn their energies to war work, such as is available and suitable to their establishments. These activities are, it is hoped, of a very temporary nature, and much thought is being given to envisage the post-war requirements of the building trade. These requirements are expected to be great, greater by reason of the tremendous urgency of the situation regarding new dwelling house accommodation than ever before, and it may tax the capacity of manufacturers of builders' castings to meet the large demands for their products.

It is the Author's intention to deal with certain aspects of plant for the production of these castings with a view to increased and economical production. It is not possible to deal in detail with all the different branches of the trade, so he will restrict himself mainly to plant for the production of stoves and general repetition castings.

Pattern Equipment

In most foundries which cater for this class of work the castings are, to a very large extent, produced by means of plate patterns. These plate patterns are generally made in cast iron, though some founders favour the adoption of aluminium with the laudable object of lessening the weight the moulder has to handle during the course of his work. This is a progressive step, especially in the use of the larger sizes of plate patterns, the weight of which in cast iron is considerable in relation to those made in aluminium, and it can be readily understood that the bodily effort effect on the moulder using the lighter type of pattern should be conducive to greater output, without undue strain.

Copper and/or zinc are generally added to toughen the aluminium; the following alloys have been found very satisfactory in service:—

Al	Zn	Cu
82	15	3
92	—	8
88	10	2

Stoves and grates are made up of a series of widely differing parts, and it is important that the utmost care and supervision are required to ensure that the parts match up together easily in the fitting shop. A very safe way to ensure that patterns will yield castings to size is to build up the parts for a sample stove as they are made from the new patterns, and any misfits corrected at once. The place most suitable for this purpose is the iron pattern shop, as this department is what might be called a " bridge " between the general stove fitting shop and the foundry. It follows that through close co-operation between the stove grate department and the iron pattern shop, the components are carefully checked as the trial stove is made up. By this means, production in the foundry of under- or over-sized parts is practically eliminated. The practice of mounting different parts of stove grate patterns on one plate should be avoided whenever possible.

It very often happens that the heavier parts go through regularly enough, but on the same plate may be one or several which are very light and, in the case of misruns or breakage the stock balance can be greatly affected. The fitting shop could easily find itself with large numbers of castings in hand and yet be unable to fit a single stove complete, for want of one or several small or light parts.

Parts which are " handed," *i.e.*, right and left hand, should never be mounted on the same plate, the dependence on good castings all the time—especially in a rush period—is often expecting too much. Here again, the stock-taking period very often reveals the disquieting features of mixed pattern plates.

It is essential that plate patterns for stoves and grates be straight and flat. A bent or twisted plate pattern, unless corrected, will give an uneven sand joint. If the sand joint be broad, it may be strong enough to support the weight of the cope, but if the sand joint be narrow it may not have the strength to support such a weight, with the result that the joint collapses and the mould inside the box is crushed off. To overcome this difficulty, " fitting strips " should be cast on the pattern plate. (See Fig. 1.) These strips are upstands approximately $\frac{1}{8}$ in. high x $\frac{1}{4}$ in. broad, and placed in positions which correspond to the corners of the moulding box. The strips are cast on both sides of the plate one above the other, the amount of correction which can be made on a plate is governed by these strips, the straighter the plate is, the less strips are required, and they must be reduced to the average thickness of the plate. In this connection, when reducing the strips they should be left slightly *above* the average thickness of the plate, say, $\frac{1}{32}$ in. This has the effect of raising the sand joint all round the box edge and creates a slight " crush " when the box parts are put together for casting, thus minimising the risk of run-outs. On the other hand, if the corners of the box parts are allowed to dig into the plate too far, the sand joint all round the box will be open to the extent of the amount of wear on the plate and, as a consequence, there is the possibility of run-outs all round the box.

The care of plate patterns is most important. When

* Paper read before the Sheffield Branch of the Institute of British Foundrymen.

Builders' Castings

not in use, they should be immediately withdrawn from the moulding shop to a conveniently situated pattern store, wire brushed, varnished and put into racks allotted to the series. If this be done systematically the life of the plates will be greatly lengthened and the effort certainly pays high dividends. If they are left lying about the moulding shops for even a short space of time they begin to rust, and steam from the hot-moulding sand at the casting period is most harmful. The pattern soon loses its polish, any scroll work or embellishments begin to lose their clear cut impression and haziness of this kind would in consequence be reproduced as such in castings made from them.

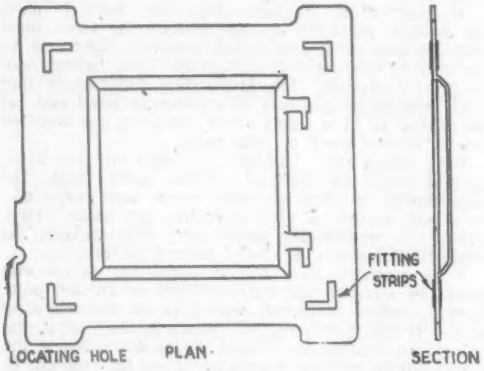


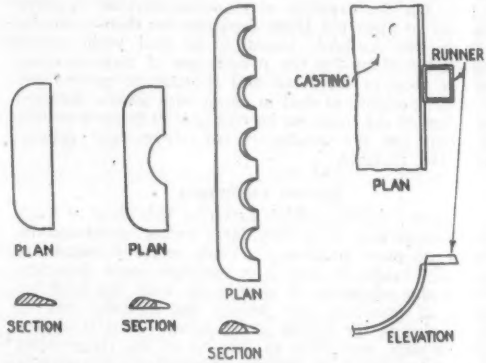
FIG. 1.—SHOWS THE USE OF FITTING STRIPS.

Runners

The type of runners used is governed to a large extent by the nature of the casting, and its place in the build up of the stove. Quite a number of castings used in a stove do not require to be of a very best finish, while others, spoken of in the trade as face castings, must be first class. The runner illustrated in Fig. 2 is quite satisfactory where perfection in every way is not vital. The weakness of this type of runner is that there is no trap against loose sand or slag from finding its way into the mould. Runners of this kind are generally used on fire bars, flue parts, etc.

The runner shown in Fig. 3 is somewhat similar, with the difference that the face, instead of being all in one piece, is divided in two. The break between the two faces of the runner thus formed has the advantage of holding up the first inrush of metal slightly, thus giving the metal a quieter approach to the mould. It is most important that the down-gate to the runner be placed immediately behind the break, if the down-gate is placed too far to the right or too far to the left of it, the inlet nearest the down-gate becomes much the same as that shown in Fig. 2, with the result that a mould cast under such conditions would be rough and possibly dirty at one runner inlet, while the other would be clean and sound.

Fig. 4 shows an extension of the previous design. It has a series of breaks and is very suitable for thin sections, which have to be free from sand and slag inclusions. The number of breaks and inlets on the runner will depend to a very large extent on the area to be cast. The inlets should be much shorter than those illustrated in previous designs, as, by reason of the number of inlets, the mould will be filled easily and quickly. It is not uncommon to find attempts being made to run castings which are long and narrow



FIGS. 2 TO 5.—VARIOUS TYPES OF RUNNERS USED IN STOVE GRATE PRACTICE.

at the narrow part (this is obviously done to conserve as much space as possible in the moulding box), but it often happens that, in order to get the metal into the mould fast enough to ensure that the mould is completely filled, distortion or swelling is set up round or near the runners; it may even be found impossible to get the runner off without breaking the casting.

Fig. 5 shows a type of runner which gives most satisfactory results for castings such as doors, interior frames, oven frames, canopies, etc. These and similar castings are, to a very large extent, finished in vitreous enamel and porosity caused either by sand or slag inclusions is fatal in a finish of this kind. It will be noted that in Figs. 2, 3 and 4 the face of the runner is cut into the mould thickness on the drag side, whereas in Fig. 5 the runner is placed on the edge of the job to be cast, the underside of the runner level with the joint. The whole of the runner is therefore in the cope. This in effect means that, when the job is being cast, any loose sand or slag is trapped above

the mould level, as the actual pouring face is on the underside of the runner. Care must be taken that the face of the runner does not project too far on to the edge of the pattern, as there is the possibility of cracking the casting when removing the runner. It is a good plan, when using a runner of this type, to thicken up the edge of the pattern slightly at the point where the edge of the runner rests on it. If given proper care and attention, this type of runner breaks off very cleanly and fettling at that part is reduced to a minimum. In assessing the suitability of runners for very light castings, the question of how both the position and the type of runner affect the camber in patterns is of the utmost importance. This is especially so where the surface is considerable and in those which are long and narrow, such as jamb mouldings, shelves, and the like.

Camber on Patterns

So far as the Author is aware, there is no literature to give laws or standards on the subject. Certain rules there are, accumulated through time by practical men and handed on, and the use of which provides a basis upon which to work. It has repeatedly been

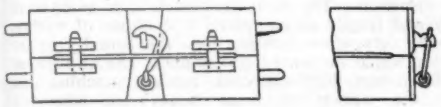


FIG. 6.—PLATE PATTERN MOULDING BOX.

proved that the amount of camber necessary to give a straight casting in one foundry will be useless in another—so many factors have to be faced. The pattern moulder can easily lose the camber when he is making the pattern or plate, because he can ram too soft or too hard. Moreover, he can make the sand bed beneath his moulding box in such a manner as to upset the camber. The temperature at which the pattern is cast can affect the camber so that it requires the strictest supervision to ensure that the patterns are cast at temperatures which give the most constant results. It also follows that, when castings are being made from patterns which have been cambered, the temperature of the metal should be as near as possible to that at which the patterns were cast.

Moulding Boxes

One of the secrets of success in the manufacture of repetition castings is contained in the provision and maintenance of up-to-date moulding boxes. This statement, obvious as it may seem, does not always get the attention it deserves. In a foundry catering for this class of castings practically all the boxes are handled without the use of mechanical means, and this calls for boxes as light in weight as possible. They must, at the same time, be so constructed as to withstand the hard usage they undergo in service. Some founders are occasionally obliged to increase the strength of their boxes owing to excessive wear and tear, and to avoid, as far as possible, the necessity of patching broken parts. For the purpose of this Paper an illustration (Fig. 6) is given of a plate pattern moulding box as used in the making of stove grate and general repetition castings. It is essential that the parts be true to each other when put together. There must be no jump or spring at the corners, as this would be sure to cause mislifts, especially so if the lift be on the deep side; or, if the section of metal to be cast is very light, there is always the danger of a crushed mould. Founders who are equipped with a machine shop can plane the face of their box parts, but, generally speaking, most firms who cater for light castings have no such facilities; in any case, this method is expensive. A speedy and inexpensive method of box fitting is to design the moulding box with fitting strips at the corners, and, in the case of long boxes, similar strips introduced at intervals along the length of the box. A description of these strips was given earlier in the Paper when dealing with plate patterns, and the principle of application is the same for fitting moulding boxes.

As most of the work in a light-castings foundry is of a repetition nature, it is comparatively simple therefore to arrange a series of general utility box sizes. The pattern shop makes up a wood model which should be used to make an iron master pattern only. This master pattern, if made with the care it warrants, will in its turn reproduce box parts which are level and true and which should require very little trimming or levelling in the fitting shop. If, on the other hand, a whole series of cast-iron box parts is made from the wood model, there is every possibility of the wood, with having been so long in contact with the damp moulding sand, getting warped and twisted, with the result that these defects are reproduced in the box parts cast from it. Box parts should always be stamped with the size or a code number to indicate their dimensions. In the yard, boxes which are clearly stamped can easily be controlled.

Two guide pins for location are sufficient for most sizes of boxes, two snugs cast on the drag half of the box to take the pins and two snugs in the cope, drilled to give a slipping fit for the pins. There is a number of ways of clamping box parts together. For general repetition work made on the floor, the hook and stud arrangement has much to recommend it. This consists of a wrought-iron hook and eye and a stud which has two steps cut out in it (see Fig. 6). The system is as follows: A hole is drilled in the cope and drag, the eye with the hook attached is riveted into the drag part, and so arranged that the hook can be swung upwards to the cope. The stud is then riveted to the cope, the steps uppermost. If the two holes have been drilled correctly, the hook should slip on to the step

of the stud and a few taps with a hammer will clamp down the box.

These hooks are made up in a series ranging from small ones suitable for very light work up to sizes which will hold down a considerable surface. The assets of this system are that the hooks and studs are fastened to the box parts and therefore cannot be misplaced. They are also very positive in action. As already mentioned, the stud has two steps—this is necessary, especially when plate patterns are being used. When the box is being rammed up the hook is so set as to engage the lower of the steps, when the plate is withdrawn and the cope closed on the hook will connect with the upper step.

Moulding Sand

For certain types of light castings, such as rainwater pipes and gutters, elaborate sand preparation is unnecessary, but in others, such as stove grate, sanitary wear, etc., the preparation of moulding sand is of outstanding importance. It will be understood that facing sand is referred to. Facing sand is sand specially prepared to be used in making the face of the mould, and is the first sand put against the pattern. It is made up of a mixture of used and new sand, the greater the proportion of new sand the stronger the mixture. There are a number of suitable types of sand throughout the country—Erith, Mansfield, and Belfast particularly so, on account of their fine grain size. To ensure stripping easily from the casting and to give a finer skin, coal dust is added to the sand. Molten metal entering a mould ignites the coal dust, thus producing a gas film between the metal and the face of the mould. This film has the effect of lessening the scouring action of the metal, and thus adding a further protection to the mould face. For very light castings the coal dust must be of superfine quality.

As the quantity of metal to be cast is relatively small the actual casting time is very short. It is therefore necessary that the gas evolution be instantaneous all over the mould surface and evenly disseminated throughout the face.

Coarser grades, on the other hand, are slower in action, and the mould might well be filled with metal before the full benefit of the gas was effected. The mixing of the facing sand should be a founder's concern and not left to individual moulders. As far as the moulder is concerned he can be more profitably employed on production. A mill situated in a place easily accessible to rail or road transport for incoming new sand and also in direct proximity to the moulding shop is a real asset. Under proper supervision a system of control can be rapidly built up whereby the essentials in a facing sand, namely, moisture, strength, and permeability, are kept within specified limits and made uniform for the whole of the foundry.

Care should be exercised in the selection of a mill, the heavy grinder type should be avoided as these tend to destroy angularity of grain of the sand, with the danger of caking on the mill bottom. A type of mill most suitable for facing sand for light castings is one in which the main function is to *mix* and aerate the sand rather than to grind it. Most foundrymen of an earlier generation will remember how they had to mix their own facing sand, getting together the various ingredients on the shop floor and turning the sand, etc., over and over again by shovel until the right strength or mix had been attained. This older method gave very satisfactory results in skin on castings, but was a slow and laborious business.

Moulding Machines

Since the advent of plate pattern moulding there has been a marked increase in production figures as compared with those of the loose pattern method. It has proved to be an efficient and comparatively inexpensive development. This development has been carried much further by the advent of the moulding machine. For a considerable period after moulding machines were introduced they were but imperfectly understood by their operators. This is hardly surprising as the average foundry worker was not conversant with the needs and requirements of things mechanical, as his training, experience and outlook had been built up along very different lines. Indeed it is no exaggeration to say that this newcomer was looked upon with grave suspicion. The early machines, it is true, were clumsy and fragile as compared with those of to-day, and were very often brought into the foundry to do work for which they were not suited. The knowledge that the robust, high powered, modern machine can relieve the worker of many heavy and laborious operations is rapidly replacing old prejudices and a more open minded approach to mechanical methods of production is increasingly evident.

Moulding machines and their henchmen the semi- and continuous casting units have speeded up the production of castings very greatly, but in the performance of their duty they make demands which, if not given prompt and continuous attention, can have repercussions severe enough to upset the whole of the work's programme. Maintenance should be the keynote, and to ensure the smooth working of all the joints of the machine and layout, constant supervision is essential.

In conclusion, the Author ventures the opinion that the repetition foundry trade, living as it does in a mechanical age, must keep in step with the times. When the post-war years make their demands for builders' castings the foundry must be ready to meet that demand with everything it has got, and the answer is surely a closer approach to the possibilities of increased production by mechanical means.

Calendars, Diaries, etc.—We have received a number of calendars and diaries, and our sincere thanks are accorded to the following firms:—Stewart & Gray, Limited, London; Stokal Enamels, Limited, Burton-on-Trent; Stewart and Lloyds, Limited; British Pigirons, Limited, London; H. Hendra & Son, Croydon; Yorkshire Repetition Castings Company, Limited, Bradford, and the Frodair Iron & Steel Company, Limited, London.

INDUSTRIAL RESEARCH AND DEVELOPMENT

EXPLOITING THE WORK OF SCIENTISTS

Mr. W. C. Devereux, F.R.Ae.S., in an address to the British Association for the Advancement of Science on January 13, recalled that in 1939 he prepared a Paper for the Association on the subject of "Industrial Research." The meeting at which the Paper should have been read, however, was cancelled, and the Paper was never presented. In that Paper a strong appeal was made for a very considerable increase in all branches of industrial research as an essential factor in meeting world competition, from countries in which research was being carried on on a far larger scale and, even more important, was being applied more rapidly to manufacturing processes and products.

It has been said that some of the foreign research which has been held up as a shining example in the past was mere window-dressing. This may be true to some extent, but this should not cause us any worry. There is nothing wrong in window-dressing; in fact, as a nation, the British have sadly neglected this important aspect of foreign trade promotion in recent years. It has been fortunate indeed that, despite this neglect consciously to display its wares in the international shop window, this country has continued to produce scientists of world-wide reputation, whose work has done much to maintain the international goodwill so far enjoyed.

The universities might well take stock of the new position created by the demands of industry for fully qualified scientific research workers and engineers, particularly in equipping them for the higher posts in research management and administration. There is undoubtedly a lack at the present time of suitable men for these posts—in some way a scientific education seems to carry with it a false superiority to business matters.

The brilliant work in metallurgical physics which is being carried on by Dr. Hume-Rothery at Oxford will have far-reaching effects on industrial metallurgy, but unless the industry can enlist a sufficient number of men with the right kind of qualifications to apply these new theories to practice, then the benefit will go to other countries, particularly to the United States, where the scale of technological education is on a far larger scale than it is here.

Development of Alloys

In the light alloy fabricating industry one of the principal research objectives is the development of alloys with improved properties and, in particular, the improvement of those properties which influence behaviour under the peculiar conditions encountered by various components under service conditions. This objective calls for the closest possible liaison with the designers and engineers using these materials, and for the continuous improvement of the technique and apparatus for testing.

Since the introduction of Duralumin in the early part of the century, and the subsequent development of "Y" alloy and the R.R. series, a steady rate of improvement has been maintained in the properties of the light alloys, but this has continued along empirical lines largely by the processes of trial and error. The important work of Dr. Hume-Rothery and the increasing data on phase-equilibrium diagrams which are becoming available, already point the way to far greater and more rapid developments in the future.

Whilst ten years ago the "ceiling" of tensile strength in light alloys was in the region of 30 tons per sq. in., gradual development has raised this figure to 40 tons per sq. in. At the present time the lecturer did not visualise any great increase on this figure, and it should be borne in mind, in order to retain a balanced outlook on this question, that, for the majority of uses, the lower strength alloys are likely to predominate in production owing to their greater ease of fabrication.

The field of casting alloys has been characterised in recent years by the conflicting claims of the high strength alloys and the lower strength but more easily cast alloys. Close study and development of foundry methods have now cleared the way for a far greater utilisation of the higher strength casting alloys

X-ray Diffraction

The technique of X-ray diffraction is finding valuable practical applications in the determination of locked-up internal stresses, particularly in forged components. It has long been realised, of course, that locked-up stresses can limit, to a very low figure, the permissible external stresses which may be applied.

It was clear that in these circumstances the performance of engine components could be improved if we could determine accurately the extent of the locked-up stresses. To deal with this we have developed an X-ray Crystallographic method,* by means of which it is possible to survey a component and to plot the internal stresses present at various points in it. This method of investigating the problem has yielded a great deal of information on the part played by heat-treatment on the distribution of internal stresses, and the problem has been resolved into one of establishing suitable methods of heat-treatment to give a predetermined stress distribution in the components.

This ability to study the magnitude and distribution of internal stresses has been of considerable value in the design of components for internal combustion turbines, for as a direct result of this work the designers can, with more confidence, use mechanical test figures of the material for design purposes.

Fatigue Failures

Another considerable advance has taken place recently in the study of fatigue. Fatigue failures have long been recognised and have been the subject of very close study for many years, but exact information on fatigue limits, particularly under conditions of superimposed tensile and bending or torsion stresses, was not very extensive. Data on fatigue limits at elevated temperatures were very scarce indeed. Improved fatigue testing methods, especially those for operation

* Frommer and Lloyd, J.Inst.Met. 70(3)91–124.

Industrial Research and Development

at elevated temperatures, give the designer, if not the ability to design components directly from fatigue data, at least the means of comparing the fatigue properties of a new material with one of known performance under fatigue conditions.

Improved methods of fatigue testing have undoubtedly played a very important part in the rapid development of the jet engine. However, this new field is so very wide and the problem so numerous that the new-born science of laboratory component testing using "stress-coat" and electric strain gauge methods and the stressing of components to simulate operating conditions is likely to be an increasingly important factor in increasing the rate of turbine development.

Damping Properties

A great deal of interest has been shown recently in a new approach to the study of materials under vibrating conditions, using the property known as damping; the property of materials which controls the amplitude of vibration at resonant frequency owing to the absorption of energy by the material itself. It was thought at one time that this factor was of importance in structures, but measurements of the actual damping of alloys show that, at low amplitudes, this is so small as to be insignificant as compared with the damping which occurs at the joints in the structure.

The measurement of damping by various methods has produced widely different results, and has given rise to some controversy. Careful measurements show, however, that while the actual damping capacity is a characteristic of the material and is independent of amplitude, it is found that this is so only under conditions involving low or vanishing amplitude, and is certainly confined to the range in which the metal is truly elastic. As soon as the amplitude of vibration becomes large enough to produce plastic deformation the apparent damping increases markedly. Measurements on light alloys show that the increase in damping coincides with the beginning of plastic deformation. Moveover, the damping value often increases with the number of reversals.

Such observations indicate a relationship between the damping values and fatigue, and if the experiments now in hand prove as fruitful as they are promising, it may soon be possible to establish the fatigue properties of a material at normal and elevated temperatures very much more quickly than is possible at the present time.

Economic and Market Research

The lecturer's "Plan for the Industrial Reconstruction of West Cumberland," which was completed earlier this year, is an attempt to assess as thoroughly as possible the natural resources of the area and the future demands for products based on those resources, and, upon the basis of this survey, to recommend the introduction of new industries to manufacture these products and to suggest expansion or contraction of existing industries. By such means it has been possible to produce a plan soundly based on the natural resources and amenities of what was formerly a depressed area, which will give full employment of a more varied and thus of a less vulnerable character than hitherto, and which, at the same time, will raise the average standard of living of those working in the area.

Market research is rapidly assuming an important function in industry, especially in relation to other forms of industrial research and development. In the past this country has failed, on numerous occasions, fully to exploit the results of its own scientific research work because we have failed to realise the far-reaching effects of new inventions or, realising them, have not had the courage to lay out the capital necessary to achieve a sufficiently large output to meet the demand, thus allowing others to get into the market on the ground floor.

The importance of a proper approach to the problem of the development of a laboratory process into a manufacturing routine cannot be too strongly emphasised. In the past this important link has been omitted in many industrial organisations, and it is still not exceptional for a new process to be passed directly from the laboratory to the works with an inevitable interruption of the smooth flow of production, and usually an unnecessarily long delay in getting the new process to work on a production scale. This also has undesirable repercussions on the research laboratories, for the temptation is strong to do development work there so that the process may succeed when handed over to the works. This results in a diversion of the research efforts.

Maintaining Development Departments

In his organisation the lecturer had found it desirable to maintain several development departments each dealing with a particular aspect of the work done. For instance, there is the Process Development Department which deals with the development of new processes and improvements in old processes which come within the scope of the normal day-to-day manufacturing activities, *i.e.*, the casting, working and heat-treatment of alloys. Then there is the Engineering Development Department, which carries on the development of new ideas for the engineering uses of the materials and goods manufactured. This work is directed to the improvement of processes which are performed on semi-manufactured products after they have been despatched from the works. It may be regarded as a development service on behalf of the customers, but in reality it is very much more than that, for it has been found that unless the works can provide this kind of information on the use of new materials, their full utilisation is delayed for a very long time, perhaps even for years, while the users gradually change over from old materials, trying out one part in the new material at a time.

Dr. E. C. R. Spooner recently resigned his position as technical superintendent to the Magnesium Metal Corporation, and has been appointed chemical engineering consultant to Sutcliffe, Speakman & Company, Limited.

METHODS AND PROBLEMS INDIGENOUS TO A GENERAL ENGINEERING IRON-FOUNDRY

The jobbing shop as a training ground for moulders

By WILLIAM MONTGOMERY and JOHN DOIG, Junr., Leven

(*Continued from page* 53.)

Metallurgical Factors

In the foundry where the interest covers a wide range of engineering castings, and where castings vary in type from tank plates to pressure cylinders, not the least of all the problems is that of melting practice. In a single day's melt castings have to be catered for, which may vary in section from $\frac{3}{16}$ in. on the light side to perhaps dies of 9 in. on the heavier side.

In the Authors' practice, two cupola melting units are used in conjunction with receivers. The larger

FIG. 25.—RADIOGRAPH: CASTING POURED AT 1,250 DEG. C. FREE FROM GAS INCLUSIONS.

unit melts 7 tons per hr., while the smaller cupola, which is in regular use every day, has a melting rate of 3 tons per hr. The receiver on the smaller furnace holds about 35 cwts. of molten metal, but the actual tap could be increased beyond this figure, depending on the size of the receiver tapping hole. After 10 tons have been run through the furnace, the receiver must be slagged. The retention of the slag would seriously restrict the holding capacity of the receiver. The only unusual feature about this furnace is the high blast pressure obtaining in the wind belt. The figure of 14 ozs. per sq. in. is considered excessive for a cupola of 30 in. dia.

It has been proved that this particular cupola will just not operate with any degree of smoothness below 12 ozs. per sq. in. pressure. This may be explained by the fact that the lining tapers gradually from the furnace bottom to a point well above the melting zone. Thus, the true working diameter must not be measured at the tuyeres, but at a point some 3 ft. above them—the melting zone level.

The main benefit to be obtained by using a receiver probably lies in the ability it provides of storing a large quantity of metal out of proximity to the coke, and hence any tendency there is to pick up carbon and sulphur from the bed is minimised. This advantage is, no doubt, more than offset by the attendant fall in temperature. Tapping metal from a receiver at 1,400 deg. C. must involve obtaining it from the cupola channel at a temperature not far short of 1,500 deg. C.

In the foundry under discussion, metal of such composition as will suit the average section of castings on the floor is decided upon, and only for special jobs and for metal sections outside these limits is any change allowed for. Iron of special composition, with or without steel, alloys, etc., is invariably melted as the first of the day's charges. Separation of the charges is effected by working strictly to a time schedule based on the melting rate of the cupola. A fairly sharp separation of the charges is obtained by adhering to this principle and, naturally, the use of the receiver considerably facilitates such separation. In melting highly alloyed irons such as the austenitic group, it is much preferred to melt the alloys separately in a Morgan tilting crucible furnace, but for heavy castings of this nature it is necessary to melt all the materials in the cupola. The latter practice is regularly done in the case of 2-ton austenitic castings, but it necessitates charging a few hundredweights over and above the amount budgeted for in the castings. The transition charges are pigged.

All steel charges, with the accompanying ferro-alloys, have been smoothly and successfully run through this furnace. Personal opinion is that the cupola is by far the most versatile unit at the command of the ironfounder and that with it there is no limitation to prevent the jobbing founder tackling any special or modern high-duty cast iron. If, at the same time, he happens to possess a small auxiliary melting unit of the crucible or preferably rotary type, so much the better, but this will not add one iota to the ability

Methods and Problems

to make special duty irons, but will only, if properly used, add to the flexibility of the melting equipment.

Sand Control

In nine small foundries out of ten no attempt at scientific sand control is made. Individual moulders usually mix their own facing sand and water it at their own discretion. Irrespective of the fact that such mixing is primitive and incomplete, the optimum properties of the sand are not being developed and maintained at a constant level in cases where even moisture contents vary from day to day. The elementary law that for every moulding sand there is a definite range of moisture content to develop optimum properties of dry strength and permeability applies equally to the jobbing foundry as it does to the mechanised shop. This fact is too often lost sight of. The above remarks are not intended to deny the experienced moulder's ability to judge the condition of his sand by the "feel," but to stress that this skill is only attained by long experience and that it often fails when new sand is introduced or variations arise.

In good practice, the sand should be mixed, aerated and tempered in a small sand-preparing bay and delivered to the moulders, as needed, in a state fit and proper for use. Moisture contents could, even in the small shop, be regularly recorded and the percentages maintained at the desired values. The methods for estimating the water percentage in foundry sands are well known and do not call for laboratory aid or expensive instruments. Broadly speaking, most foundry faults and castings defects are caused by metal composition, sand condition and pouring temperature either considered singly or in combination. Of this triumvirate of foundry worries, sand condition is not the least.

Pouring Temperatures

The effect of pouring temperature on a sand containing 7.0 per cent. moisture and using metal with carbon and silicon content of 3.3 per cent. and 2.7 per cent. respectively is amply demonstrated in the radiographs shown in Figs. 25, 26 and 27. The test castings used were all moulded and run in a similar manner and, although the metal composition was such that would ensure good fluidity, the gas trapped is considerable. As the pouring temperature decreases from 1,260 deg. C. to 1,220 and 1,180 deg. C., so does the incidence of mould gases become more and more apparent in the radiographs. X-rays are of real value because one can actually see the gas pockets and visualise what has taken place. This is much more impressive to the practical man, and carries more weight than all the glib talk of angular grains and impermeable sand. The practical results of variations in moisture content of sand can be similarly demonstrated by means of radiography.

An interesting point arose in connection with the "salt-box" casting described earlier. When made with an iron of somewhat low total carbon content (2.9 per cent.) the result was that a great deal of mould

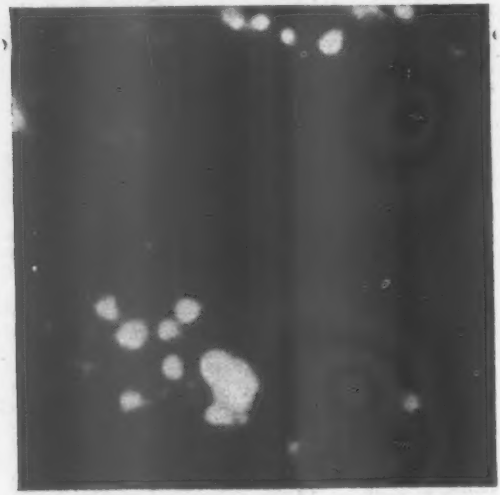


FIG. 26.—RADIOGRAPH: CASTING POURED AT 1,220 DEG. C. GAS INCLUSIONS EVIDENT.

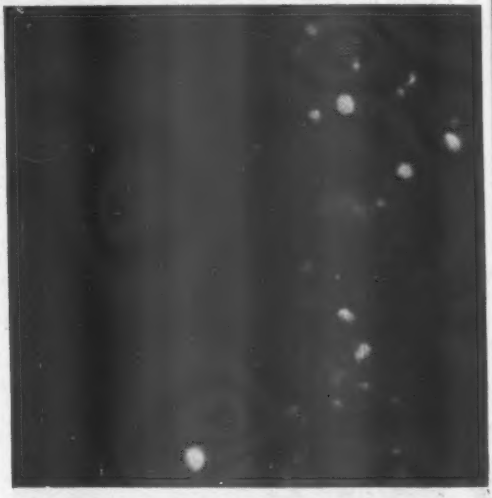


FIG. 27.—RADIOGRAPH: CASTING POURED AT 1,180 DEG. C. GAS CAVITIES MUCH IN EVIDENCE.

gas was trapped above the greensand core. This was only shown by radiographing the susceptible area of the casting, and Fig. 28 will give a fair idea of the extent of the gas inclusions. Casting hotter certainly overcame some of the gas difficulty, but resulted in " scabbing " from the greensand core. Only by altering the metal composition to render the iron more fluid was a satisfactory casting produced. In broad terms, the moulding sand question should be a major consideration in all foundries; but in the specific case of the general engineering shop the choice of sand, as the choice of metal, must in the long run be rather a compromise.

Although the Authors deplore concluding on a wistful note, it is their opinion that this ability to effect a compromise and the tendency to be ever apprehensive over the unexpected are the peculiar merits of the jobbing ironfounder. Still they are naive enough to ask themselves if there is a foundry manager anywhere who has not sometimes looked at a casting with the despairing thought—

" ——— would we not shatter it to bits,
and mould it nearer to the heart's desire!"

Finally, the Authors' thanks are due to Mr. W. Lindsay Burns, managing director of H. Balfour & Company, Limited, Leven, for permission to read this Paper, and to Mr. J. Doig, Senr., foundry foreman, for much helpful advice.

DISCUSSION

MR. T. TYRIE, B.Sc. (Section chairman) expressed his appreciation of the quality of both Paper and illustrations, and said that he would like to ask the following questions: (1) Was the casting of the wheel blank by means of dummy risers successful? Were sand cores used, and were the conditions of atmospheric feeding fulfilled? Was there a runner or riser on the boss?; (2) in the still section mould, was the core blank, or filled with ashes, as well as being reinforced with brick? and (3) in connection with the radiographs showing the effects of water vapour on the sample castings, was there any evidence of the gas holes on visual examination of the castings?

MR. MONTGOMERY, in reply, said that the method was successful, and that cores were used, and vented through to the outside of the mould. There was no riser on the boss, reliance being placed on progressive solidification. The hot metal passed through the feeders and along the spokes, becoming relatively colder, so that solidification takes place progressively towards the outside of the mould. On machining, the casting was found to be perfect. In the still section the core was blank, and there was no external evidence of gas holes in the sample castings.

MR. W. W. BLAIR asked whether the defects would have been evident on sand-blasting the plates, and if they had been magnified in the illustration? In the wheel blank risers, was the path of the metal shown in the section?

MR. MONTGOMERY said that the defects would not have shown on the plates being sand blasted, and that the illustration showed roughly the true size of the cavities, approx. ¼ in. dia.

MR. TYRIE commented on the number of instances where a seemingly perfect casting became literally " pock-marked " on being sand blasted, due to subsurface gas holes.

MR. BLAIR said that he would like further to know whether radiographs of enamelled castings would show hollow defects in the enamelled surface, but was informed that this would only be so if the defect was very gross, as the relative densities of iron and enamel were against radiography showing defects in the latter.

MR. R. R. SHAW asked if the camber on the bedplate shown had been put on by the moulder, also whether any formula was used to assess this? He would also like to learn, on hearing the casting temperatures of the sample plates, whether the Authors would not recommend a temperature below 1,260 deg. C.?

(*Continued overleaf, column* 1.)

FIG. 28.—RADIOGRAPH: SHOWING GASES TRAPPED IN TOP OF " SALT BOX " CASTING.

METHODS AND PROBLEMS INDIGENOUS TO A GENERAL ENGINEERING IRONFOUNDRY

(*Continued from previous page.*)

MR. MONTGOMERY, in reply, said that it was preferable that camber be put on by the patternmaker, but in the case of the bedplate, the moulder had allowed about ¼ in. for it, consequent upon experience gained with the first casting. Camber was progressive with hardness of the iron used. Dealing with the second part of the question, Mr. Montgomery remarked that the optimum pouring temperature closely depended on the permeability of the sand in use. Generally speaking, in casting below 1,250 deg. C. in greensand, gases were certain to be entrapped. In his opinion, if all the engineering castings in Great Britain were radiographed, about 90 per cent. of them would prove a shock to engineers!

MR. J. A. MCINTOSH asked whether in costing a job such as the bedplate casting allowance was made for the possibility of the first attempt being a failure due to camber trouble.

MR. MONTGOMERY replied in the negative, saying that each job was judged on its merits, and camber was allowed according to previous experience.

Finally, MR. R. R. TAYLOR asked in connection with the standard cast iron mentioned, was steel used in the charge, and what was the average phosphorus content?

MR. MONTGOMERY assured him that no steel was used in this iron, which had an average phosphorus content of 0.7 per cent. Steel was only used in making special qualities of cast iron.

On the call of the Chairman, a vote of thanks was accorded the joint Authors of the Paper.

HANDLING, STORING AND JOINTING GRAPHITE ELECTRODES

(*Continued from facing page.*)

mately 1 in. into the nipple, making a depth of 4½ in. from the periphery for 18-in. electrodes with standard size nipples, and 5½ in. for 20-in. electrodes with standard size nipples.

(3) Insert a ½-in. graphite rod (standard centreless ground to 0.500 in. max. is recommended) to the full depth of the hole and break off any protruding length. Regular ½-in. by 12-in. stock is recommended, one piece making two joints.

(4) Should it ever be necessary to take an electrode joint apart, the peg should be drilled out. When and if the same joint is reassembled, the resulting abrasion of the threads will probably allow it to be tightened a slight part of a turn further than the initial assembly. Therefore, it is always a wise procedure to drill a new hole on a reassembled joint.

During the last financial year Iscor produced 466,216 tons of steel, as compared with 377,300 tons in 1943.

FLUORESCENT TUBULAR LAMPS

Three simultaneous developments in regard to the size of Osram fluorescent lamps have opened up entirely new possibilities in their application. The first of these is the introduction of a lamp of a new colour, known as "warm white." The original fluorescent tubular lamp was introduced primarily for industrial purposes to assist the war effort, and it was felt that a colour of light very closely approximating to that of daylight would be the ideal for this purpose. Experience has proved that this decision was a good one, and apart from the considerable psychological value of light of daylight colour, it has enabled many industrial operations to be carried on under black-out conditions for which in the past natural lighting had been considered essential.

The second factor which will influence the adoption of these lamps is the reduction in price. This reduction, which applies to both lamps, will make the economic advantage of their installation even greater than it has been in the past. The high efficiency of the fluorescent lamp has always meant that for equal light output there has been substantial saving in current costs as compared with tungsten lamps, but much of this saving has been offset by the greater cost per lumen hour involved in lamp replacement.

The third factor which will make for greater adoption of these lamps is the cancellation of the Statutory Order (S.R. & O. 1201) which required that a licence shall be secured for all new installations of electric discharge lamps and gear. Recently this Statutory Order has been withdrawn and fluorescent lamps may now be installed under any conditions where the installation of other types of lighting would previously have been permitted. Fittings and gear, however, involve the use of steel and other raw materials which are still in short supply, and therefore for the present it will only be possible to supply the lamps for installation where a necessary "M" Form for the use of metal is available. For industrial lighting installations a certificate by the Factory Lighting Inspector that improved lighting is necessary will serve as sufficient authority for the supply of the necessary equipment.

A NOVEL CALENDAR

An unusual novelty is exhibited in a wall calendar received from John Gardom & Company, consulting engineers, of Ripley, Derbyshire. It has been produced in their own drawing office for internal use. At the side it carries four graphs, two of which the reviewer believes are quite new. One sets out cupola combustion conditions, and the second recommended compositions for high-duty irons. The other two graphs cover cupola data and hardness conversion curves.

Mr. R. C. Stanley, the chairman and President of the International Nickel Company of Canada, Limited, has been awarded the 1944 American Society of Metals Gold Medal for his work in the advancement of research.

HANDLING, STORING AND JOINTING GRAPHITE ELECTRODES

Mr. R. L. Baldwin, of the National Carbon Company, Niagara Falls, N.Y., writing in "Metals and Alloys," gives some useful hints designed to get the best out of graphite electrodes.

Handling and Storage

Electrodes leave the factory with surfaces in proper condition to permit good contact with electrode holders and with the end faces and threading accurately machined to ensure effective joints. Surface abrasions or chipped end faces result in poor electrical contact and minimise electrode effectiveness as a current conductor.

For this reason great care should be taken to prevent breakage, chipping or marring during delivery in railway trucks and during removal from box cars at the works. Storage should be provided in the form of well-designed racks, preferably of steel. Where a steel rack is not possible, 2-in. by 4-in. timbers should be placed on the floor and the electrodes stacked evenly upon them, with additional timbers separating the electrode layers. Where shipments are in less than carload lots, the boxes in which the electrodes are packed should be moved on rollers or by hand truck and not by turning end-over-end.

Normally, cranes are available for moving electrodes from racks or piles to the furnace. If not, a set of chain blocks suspended from a trolley on an I-beam should be rigged for the purpose. To lift an electrode from its horizontal storage position to vertical furnace position, use only a steel lifting plug threaded to screw into the threaded electrode end. The plug should be equipped with a swivel eye to facilitate the turning of electrodes during joint assembly.

Nipples are important to the performance of electrodes. They are shipped in cartons, and should not be removed from these containers except when needed for joint assembly. Electrode joint compound used in carbon electrode joint assembly is shipped in sealed containers holding 50 lbs. These, too, should be stored in a warm place and should remain sealed except when in actual use. If the container opened for use remains uncovered, the compound will become contaminated by dust and other extraneous matter.

Graphite Joint Assembly

If a single factor relating to the use of electrodes could be termed "most critical," that factor would probably be joint assembly. Mechanically, the joint is the weakest part of an electrode. The joint is the only part of an electrode where electrical conductivity, or resistance, is not predetermined and fixed in the manufacturing process. Both the mechanical strength of an electrode and its electrical resistance are to a very large degree dependent upon proper joint assembly.

A loose joint means a weak joint. It also means that the nipple may have to carry the entire electrical load, which in cases of high current density, makes for waste of power at the joint sections. The tighter the joint is drawn, without fracturing, the better. On an electrode 10 in. in diameter, for example, one man pulling hard on a chain wrench with a 48-in. handle would make a satisfactory joint.

The following rules for graphite joint assembly are extremely important:—

(1) Use compressed air for all cleaning operations.

(2) Blow dust and loose particles from socket at upper end of the electrode in the furnace. When conditions are particularly dusty it is advisable to first brush end faces and sockets with a fine wire brush.

(3) Clean new nipple of dust and loose particles. Carefully screw it as far as possible into the cleaned electrode socket. Avoid chipping threads and cross threading. Make certain nipple is firmly seated.

(4) Carefully screw lifting plug into socket of new electrode and carry to furnace with crane hoist. Blow dust and loose particles from bottom socket of new electrode.

(5) Swing new electrode into position directly over electrode in furnace and lower until nipple is just entering bottom socket of new electrode. Turn new electrode round and round and at the same time slowly raise the electrode which is in the holder, using hand control on regulator to raise electrode. Screw down until end faces are ¼ in. apart. When joining electrodes, make sure that the new electrode is always supported on the swivel hook attached to the crane so that no weight is thrown on the threads of the nipple. Use an assembly wrench for all turning operations.

(6) Blow dust and loose particles from between faces and then bring the faces together by applying a slow, steady pressure on the wrench.

(7) Give two quick pulls of wrench to complete tight joint assembly. The contact end faces of the electrodes must be tightly together.

(8) Still suspending the whole electrode assembly from the crane, loosen the electrode holder and run it up past the threaded section of the new electrode.

(9) Never tighten electrode holder directly on the joint between two electrodes.

(10) Keep joint tight at all times.

It has been found that operators sometimes find difficulty in maintaining tight electrode joints when using large diameter graphite electrodes, and when operating at high values of voltage and current, as the high voltage and current induce severe vibration in the electrode supporting structure. To remedy this, a simple and effective solution called "pegging" has been adopted. Pegging is accomplished as follows:—

(1) Assemble the joint in the conventional manner, drawing it up as tightly as possible.

(2) Drill a ¼-in. hole exactly at the interface of the electrodes with a portable high-speed drill. The centre line of the hole should be radial in direction and should coincide with the plane of the interface as closely as possible. The hole should extend approxi-

(Continued on facing page, col. 1.)

PERSONAL

MR. FITZHERBERT WRIGHT has resigned his seat on the board of the Butterley Company, Limited.

MAJOR H. E. CRAWFURD, chairman of the National Federation of Scrap Iron and Steel Merchants, is in a nursing home and has had a surgical operation. He is making satisfactory progress.

MR. J. W. PENICUD, the well-known furnace designer, and his son have—after four years—been released from internment. Their address is 3, rue de Montempoivre, Paris, xiii.

MR. VINCENT E. UPTON, director; MISS D. V. WALKER, private secretary; MR. HENRY BOOTH and MR. HARRY OLIVER, sales managers, have all completed 25 years' service with Leigh & Sillavan, Limited, of Manchester.

MR. C. A. CLARKE, who has represented the Power Plant Company, Limited, in the Manchester area for a great many years, has retired. MR. J. F. BRADSHAW, of 24, Hawthorn Avenue, Eccles, has been appointed by the company as their manager in Manchester.

MR. J. A. BROWN, who was area office manager in Scotland and Northern Ireland for David Brown & Sons (Huddersfield), Limited, for fourteen years prior to the war, has now resumed this position at 29, St. Vincent Place, Glasgow, C.1. MR. R. E. WARDLAW, who has been officiating in Mr. Brown's absence, will continue in his capacity as sales engineer.

MR. ERIC GARDNER has been presented by the directors of Hadfields, Limited, of Sheffield, with a set of seven technical books in recognition of their appreciation of the fact that he gained the first prize and silver medal in the final examination on patternmaking organised by the City and Guilds of London Institute. Mr. A. Roebuck, works director, made the presentation. May we add our congratulations also?

SIR MURRAY MORRISON, managing director of the British Aluminium Company, Limited, is retiring from that office as from March 30 next. Sir Murray, who will complete 50 years' service with the company in February, will remain on the board. The board have appointed MR. GEOFFREY CUNLIFFE (now general manager) and MR. GEORGE BOEX (now technical manager) to succeed Sir Murray as joint managing directors.

MR. WILLIAM JACQUES, who has been with the Daimler Company, Limited, Coventry, for 33 years, has retired. During his career he had been in charge of the patternshop, and later held the position of assistant manager of the foundry. For some time past Mr. Jacques had been in poor health. He was recently presented with a wireless set and an electric clock, subscribed for by his colleagues in the foundry, patternshop, laboratory and hardening department.

WILLIAM DENNY & BROS., LIMITED, the Dumbarton shipbuilders, are celebrating their centenary.

CONTROL OF EXPORTS

Under the existing Export of Goods (Control) Order, (*a*) all goods require licences on export to certain destinations, and (*b*) the goods specified in the schedule to the Order require licences on export to all destinations. The Export of Goods (Control) (No. 1) Order, 1945, made by the Board of Trade on January 9, and operative as from January 15, removes certain countries from the list of destinations referred to in (*a*) and reduces such destinations to the following:—Andorra, Burma, China, Liechtenstein, Portugal (including Madeira, the Azores, and the Cape Verde Islands), Rio de Oro, Spain (including the Canary Islands and the Spanish Zone of Morocco), Sweden, Switzerland, Tangier Zone, Turkey, including the Hatay, and the Union of Soviet Socialist Republics, and enemy territories.

The main effect is to free most Middle East countries, including Cyprus, Egypt, Iran, Iraq, Palestine, and Syria from restriction (*a*). The Export of Goods (Control) (No. 1) Order, 1945, does not affect the requirement in (*b*) above, and goods included in the schedule to the previous Order will continue to be subject to the licensing requirement on export to any destination.

Copies of the Order (S.R. & O., 1945, No. 12) may be obtained from H.M. Stationery Office (price 1d.).

SCIENCE AND INDUSTRY

"The Place of Science in Industry" was the topic of a conference of the British Association (Division for the Social and International Relations of Science), at the Royal Institution, London, on June 12 and 13. The eleven Papers included an address by Dr. D. P. Riley, on the application of X-rays in various fields of science; an account by Dr. S. G. Hooker (chief development engineer, Rolls-Royce northern factories) of the Merlin engine from 1938, when it was decided to give it priority over everything in the Rolls-Royce factory; a Paper by Mr. W. C. Devereux on the application of research and development in light alloys; and one by Sir Lawrence Bragg, F.R.S., on "bottlenecks" impeding the application of science to industry.

IT WAS ANNOUNCED some time ago that Peru intends to build an iron and steel works in a hitherto unexploited part of the country. Marcona iron-ore deposits near the bays of S. Nicholas and S. Juan are to be exploited, and the works erected at Chimbote after the port has been developed. Bituminous coal deposits are far removed from the coast, and have poor coking characteristics. On the other hand, anthracite deposits are more conveniently placed, and hitherto it has been found difficult to dispose of smalls; but it has now been ascertained that the breeze mixed with a little tar yields an excellent metallurgical coke suitable for both blast-furnace and foundry use. H. A. Brassert & Company are the consultants.—("The Iron Age.")

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THE STANTON IRONWORKS COMPANY LIMITED NEAR NOTTINGHAM

NEWS IN BRIEF

PERMISSION TO DEAL in the 143,000 new 5s. shares of British Steel Constructions, Limited, has been granted by the Stock Exchange.

THE LLANTWIT ENGINEERING & FOUNDRY COMPANY, LIMITED, is being wound up voluntarily. Mr. A. Bassett, 59, Waterloo Gardens, Cardiff, is the liquidator.

STEPHENSON CLARKE & ASSOCIATED COMPANIES, LIMITED, the old-established firm of coal factors and shipowners, has changed its name to Stephenson Clarke, Limited.

THE BASSETT ORE & METAL COMPANY, LIMITED, ore and metal merchants, of 15-18, Lime Street, London, E.C.3, have changed their name to "Bassett Smith & Company, Limited." The directors and managers remain unchanged.

OWING TO THE FAILURE of scrap supplies and to shortage of foundry coke, all departments of Allied Ironfounders (Ireland), Limited, at Waterford were forced to close down recently. However, a resumption has now been made. The company is chiefly engaged in the manufacture of cast-iron cooking utensils, peat-burning stoves and ranges, etc.

THE UNITED STATES WAR PRODUCTION BOARD anticipates that 10 per cent. more steelworkers will be employed in the post-war period than are working in the industry at present. This prediction is based in part upon the peacetime necessity for more workers in finishing operations which have been abandoned in wartime, and in part upon a shortened working week.

NEWCASTLE-UPON-TYNE EDUCATION COMMITTEE has considered difficulties experienced by secondary school youths over the age of 16 years 6 months in securing apprenticeships in the shipbuilding and engineering industries. The Committee has decided to ask the employers and employees to agree to some modification of the existing rules to deal with boys of this class.

THE IRONSTONE ROYALTY OWNERS' ASSOCIATION has lately been formed to represent the interests of landowners affected by ironstone mining and to offer their contribution towards the solution of land restoration problems. The Association has engaged the services of technical and financial advisers. The offices of the Association are at West Street, Kettering, Northants, and the first chairman is the Duke of Buccleuch.

THE FOUNDRIES AND ENGINEERING COMMITTEE of the South Wales and Monmouthshire Industries Association, at a recent meeting, discussed aspects of the industrial development to be expected in South Wales and Monmouthshire after the war. The secretary (Mr. John Pares) stated that the applications for factory accommodation in the area were almost overwhelming. One requirement would be repetition castings.

NOTABLE CONTRIBUTIONS to war charities have been made by the staffs of the Iron and Steel Control and the British Iron & Steel Corporation, Limited, stationed at Ashorne Hill, Warwick, and Sheffield, since late in 1940. The total raised to date from weekly contributions, sales of work, dramatic performances and other entertainments, etc., amounts to almost £4,000, of which approximately one-half has been devoted to the provision of a regular monthly parcel of tobacco and cigarettes to a number of merchant seamen captured by the enemy while blockade-running from Sweden to this country, the full story of which was made public a month or two ago.

MR. T. P. COLCLOUGH, addressing the Cleveland Institution of Engineers, at Middlesbrough, on "Considerations of Blast-furnace Practice," said there seemed to be no hope of a fall in the price of blast-furnace coke, and if we were to maintain the position of the iron and steel industry it was essential that coke consumption should be reduced and every ounce used to the best advantage. It was highly desirable, he said, that a survey of British ores should be undertaken to determine the maximum size which should be charged into the furnace. With correct preparation of British ores it was to be anticipated that a reduction could be effected in the consumption of blast-furnace coke.

OBITUARY

MR. JOHN HUDSON MEEK, who had been resident manager of the Scotia Engine Works of Richardsons, Westgarth & Company, Limited, died recently at Sunderland at the age of 80.

MR. JOHN WILLIAM CROSS, chairman and managing director of William Cross & Son, Limited, ironfounders, West Bromwich, died on January 9, in his 83rd year. He was for over 50 years senior director of the company.

MR. J. H. BOYES, who had been for many years in charge of the test house at the ironworks of Lowmoor Best Yorkshire Iron, Limited, died on January 9, after a short illness. Aged 55, he was well known to inspecting engineers in all parts of the country.

MR. HENRY ARNOLD MELLOWES, who has died, aged 57, was chairman of Mellowes & Company, Limited, Sheffield, of Fielding & Son (Werneth), Limited, and of the Orb Engineering Works, Limited, Middleton Junction, Manchester. He began his commercial career with Head, Wrightson & Company, Limited, Thornaby-on-Tees.

MR. JOHN WRIGHT, manager and director of the Colville Constructional Company, Limited, who has died at his home in Glengarnock, was one of the first to believe in the application of electric welding to structural engineering, and was regarded as an expert in the subject. A native of Kilbirnie, he entered the Colville Company's employment at Glengarnock about 40 years ago, holding various positions, including that of chief draughtsman, until his appointment as manager and director eight years ago. He was an ex-chairman of the Scottish branch of the Institute of Structural Engineers. Mr. Wright was 55 years of age.

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NEW COMPANIES

("Limited" is understood. Figures indicate capital. Names are of directors unless otherwise stated. Information compiled by Jordan & Sons, 116, Chancery Lane, London, W.C.2.)

Hubbard Combustion, 12, Clarence Street, Kingston-on-Thames—Heating engineers, etc. £6,000. W. A. Hubbard and H. C. Hopper.

B. J. Weldon & Company, 354, New John Street West, Birmingham—Brassfounders. £5,100. E. M. Morris, T. J. Adderley, and A. Young.

J. Cooke & Sons (Ilkeston), The Vines, Station Road, Ilkeston, Derby—Scrap and metal merchants. £5,000. F. W. and M. A. Cooke and W. H. Hallsworth.

Whiteley & Holroyd, Providence Works, Ellenthorpe Street, Bradford—Manufacturers of electrical fittings and accessories, etc. £10,000. R. W. Short and B. Taylor.

R. J. Adcock & Company, Islip Works, Islip Street, London, N.W.5—Manufacturers of electric motors and apparatus. £5,000. R. J. M. Adcock and E. K. Randall.

V. Harvey & Son, 12, Museum Place, Cardiff—Manufacturers' agents, dealers in steel products and engineering supplies, etc. £1,000. F. H. J. and C. M. Harvey.

Carter & Murdoch, 62, West Street, Dorking, Surrey—Mechanical, electrical, agricultural and general engineers, etc. £6,000. G. H. Carter and D. Murdoch.

G. & B. Company (Leicester), Allen House, Newarke Street, Leicester.—Metal casement manufacturers and engineers. £4,000. H. N. and H. G. Gandy, and H. W. Brown.

George Taylor & Sons (Accessories), Enfield Works, St. Georges Place, Great Hampton Row, Birmingham, 19—Coppersmiths, engineers, etc. £8,000. G., A. L., L., A., and P. J. J. Taylor.

Fuelycon Stokers, Railbridge Buildings, Fairmile Road, Christchurch, Hants—Manufacturers of stoves, stoking apparatus, etc. £100. W. J. Weavers, H. C. Byrte, W. H. Franklin, and G. Williams.

A.G.M. Industries—Engineers, toolmakers, founders, etc. £100. R. A. Gower, A. R. Mills, S. J. Ashbridge and H. Warman. P. F. Hedges, 5, Hamilton Gardens, Hockley, Essex, subscriber.

Hiduminium (British Exports), 95, Farnham Road, Slough, Bucks—Dealers in light metals and alloys, etc. £10,000. W. C. Devereux, H. G. Herrington, S. Sanders, E. A. Reynolds, A. J. S. Aston, and D. M. Moffat.

J. P. Pocock & Company, 365a, Clapham Road, London, S.W.9—To take over the business of welders and engineers carried on at Watford and Clapham as the "Mechanical Trades Engineering Company." £6,000. J. H. Pocock and R. F. Tiller.

Engineers & Founders (Salampton), 24a, Darlington Street, Wolverhampton—To act as selling organisation for members, etc. £200. T. R. Williams, Hurst Engineering Company, Limited, Vernier's (Shropshire), Limited, Waddington Tools, Limited, F. Ward-Martin, and O. J. G. Wootton.

NEW PATENTS

The following list of Patent Specifications accepted has been taken from the "Official Journal (Patents)." Printed copies of the full Specifications are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. each.

566,121 MUFULIRA COPPER MINES, LIMITED (Grey, G. F.). Heat-treatment of manufactured articles and furnaces therefor.

566,128 ORAM, J. E., GRENE, G. H. S., and WILD-BARFIELD ELECTRIC FURNACES, LIMITED. Electric heating of moulds, press tools and the like.

566,218 MACNAIR, J. L. P., and GARDAM, G. E. Electrodeposition of chromium.

566,249 SHORTER PROCESS COMPANY, LIMITED, and SHORTER, A. E. Production of shaped ferrous metal parts having surface hardened profiles.

566,263 WARBURTON, J. W. Manufacture of ferrous wire.

566,295 O'ROURKE, F., and KINGCLIFFE ENGINEERING COMPANY, LIMITED. Drums or containers particularly suitable for rotary furnaces and ball mills for grinding and mixing.

566,319 BARRATT, W. G., HIND, S. R., and HALSALL, J. Y. M. Muffle furnaces.

566,339 JONES & ATTWOOD, LIMITED, and FOLKES, H. L. Means for producing foundry moulds.

COMPANY RESULTS

(Figures for previous year in brackets.)

Zinc Investments—Interim dividend of 2½% (same).

British Piston Rings—Interim dividend of 5% (same).

Brooke Tool Manufacturing—Trading profit, £33,626 (£32,932); dividend of 20% (same).

Aston Construction—No dividend on the ordinary shares for the year to September 30 last (2½%).

J. Samuel White & Company—Net profit to September 30, £55,943 (£56,240); dividend of 6½%, tax free (same).

Allied Ironfounders (Ireland)—Profit to June 30 last of £9,457 (£7,834), reducing the debit forward, after £2,300 for taxation, to £2,478.

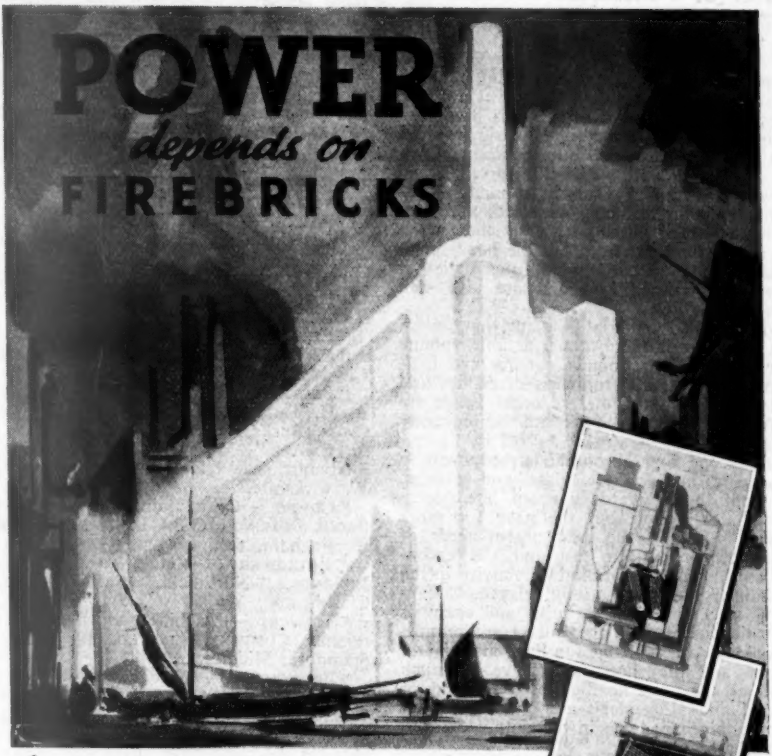
Birfield Industries—Net profit for the year to September last, £87,590 (£75,445); to general reserve, £10,000 (£20,000); reserved for capital redemption, £10,000 (same); ordinary dividend of 12½% (same); forward, £67,058 (£43,980).

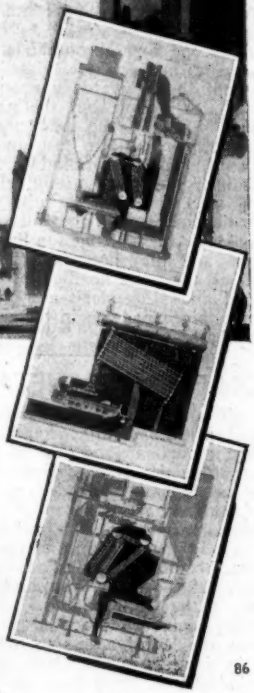
CONTRACTS OPEN

Any date given is the latest on which tenders will be accepted. The address is that from which forms of tender may be obtained.

Cheltenham, February 3—Castings during the 12 months ending March 31, 1946, for the Town Council. Mr. G. G. Marsland, borough and water engineer, Municipal Offices, Cheltenham.

Tyldesley, February 10—Cast-iron manhole covers and frames, for the Urban District Council. Mr. N. Chamberlain, engineer and surveyor, Town Hall, Tyldesley.





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Raw Material Markets

IRON AND STEEL

Careful supervision of the distribution of metallurgical coke ensures adequate supplies of fuel for the blast furnaces and output of pig-iron keeps pace with current requirements. Big tonnages of basic iron are consumed in the steel furnaces, but requirements of the foundry trades are still well below normal, and licensed tonnages are coming regularly to hand. Relatively little hematite ore is being imported, and consequently it has not been possible to relax the restrictions on the use of hematite iron, but the heavy engineering foundries have access to plentiful supplies of low-phosphorus and refined iron and are also well supplied with scrap.

Pressure for re-rolled material is somewhat easier, but the mills still have in hand a considerable volume of orders for light sections, rounds, squares and flats, and are taking up substantial tonnages of primes and defective billets. Sheet bars, on the other hand, are fairly plentiful and defective bars are consequently less easily cleared.

There is still scope for substantial improvement in the flow of specifications for steel plates and sections. Requisitions from the shipyards have of late undergone a marked contraction, but the need for more ocean transport is one of the most urgent needs of the war, particularly in the Far East, and it is reasonable to suppose that an acceleration of activity in the shipbuilding industry will not be long delayed. Meanwhile, if heavy steel plates, heavy joists and channels take an inconspicuous place in the rolling programme, substantial bookings are in hand for light material of all descriptions, and the sheet mills have as much work in hand as they can handle up to the end of March. Special and alloy steels are only quiet, but there has been a big expansion in the output of shell steel and shell bars.

NON-FERROUS METALS

There are still ample supplies of copper available for the war industries, and no shortage is expected in the future, even though a good deal of the Canadian and Rhodesian production is to be diverted to America, where copper needs have expanded again. Civilian production of goods containing copper is slow to expand and spectacular developments in this direction are unlikely, at least in the near future, for the authorities are expected to move cautiously for a time in the light of events on the Western Front and the increased call for copper in the United States.

While economy must be practised so long as the United Nations are denied access to the Far Eastern deposits, the tin situation is not wholly unsatisfactory. The tinplate industry is being kept on short rations, but in other directions it would seem that a fair amount of tin is being used. There is little change in the supply position as regards lead and zinc, which are obtainable fairly freely in connection with house repairs and readily for war purposes, but so far in limited quantities when required for ordinary civilian purposes. The U.S. Government has advanced by some 40 cents per lb. the price paid for Mexican lead with the object of preventing a decline in output. An increasing amount of aluminium is being used for non-war purposes, both in this country and in America.

NEW TRADE MARKS

The following applications to register trade marks appear in the "Trade Marks Journal":—

"AMCOL"—Metals and alloys. ANTI-ATTRITION METAL COMPANY, LIMITED, Glengall Road, London, S.E.15.

"MORGANITE"—Crucibles, etc. MORGAN CRUCIBLE COMPANY, LIMITED, Battersea Church Road, London, S.W.11.

"EUTALLOY"—Welding metals. EUTALLOY & WELDING PROCESSES, LIMITED, 10, Parkway, Welwyn Garden City, Herts.

"PLASTSET" AND "FRACTRO"—Refractory cements. A. H. TAGGETT, LIMITED, Station Road, Gerrard's Cross, Bucks.

"CASTLE"—Measuring gauges. HENRY JOSEPH SHADBOLT, 298, Old Chetser Road, Castle Bromwich, Warwickshire.

"COMPO"—Oil-retaining bronze bearings. BOUND BROOK BEARINGS (G.B.), LIMITED, Birch Road, Witton, Birmingham, 6.

"RETRIEVER"—Metal valves. ARTHUR LAKE JENNINGS, "Northfield," Snelsins Lane, Moorend, Cleckheaton, Yorks.

"TREVERT"—Machine tools. QUICKSET TOOLHOLDER COMPANY, LIMITED, 10, Floriston Gardens, Stanmore, Middlesex.

"PROMONTORY"—Machine tools, and welding machines. THOS. P. HEADLAND, LIMITED, 164-168, Westminster Bridge Road, London, S.E.1.

"OROPHON" and "OROGRAPH"—Supersonic apparatus for detecting flaws in metal. HENRY HUGHES & SON, LIMITED, 107, Fenchurch Street, London, E.C.3.

CANNON (Device)—Installations and apparatus for lighting, heating, steam generating, cooking, etc. CANNON IRON FOUNDRIES, LIMITED, Deepfields, Bilston, Staffs.

"CANNON"—Retorts, experimental stills, apparatus of enamelled cast iron for laboratory use, etc. CANNON IRON FOUNDRIES, LIMITED, Deepfields, Bilston, Staffs.

"ALUMELT"—Fusible salts for use in the heat treatment of metals and alloys. BRAYSHAW FURNACES & TOOLS, LIMITED, Boundary Street, Hyde Road, Manchester.

"HAGCO"—Machine and machine tool parts, cylinder liners, etc. HAROLD ANDREWS GRINDING COMPANY, LIMITED, 505, Bristol Road, Bournbrook, Birmingham, 29.

"SIL-FOS"—Unwrought and partly wrought phosphorus alloys of the common metals. JOHNSON, MATTHEY & COMPANY, LIMITED, 78, Hatton Garden, London, E.C.1.